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An in depth study of how the psychological behaviors affect construction safety

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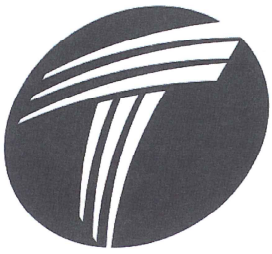

College of Technology

An in depth study of how the psychological behaviors affect construction safety

In partial fulfillment of the requirements for the
Degree of Master of Science in Technology

A Directed Project

By

Kyle Quinn

Committee Member	Approval Signature	Date
Bryan J. Hubbard, Chair	Bryan J. Hubbard	4/27/2010
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Abstract

Construction safety has been overlooked and the construction industry is now ranked 2nd in top fatalities (Bureau of Labor Statistics (BLS), 2009). As new laws and regulations are being set forth and incentive programs being produced, companies are becoming more aware of safety issues. This report investigates why construction industry safety record is so poor and identifies ways to get the workers in the construction field involved with safety. The study proposes to answer questions regarding what makes people want to be safe - is it the risk of dying, the risk of losing their job, or will incentives increase safety compliance? A poor safety record reflects negatively on a company and by improving their safety records companies will save money. The proposed study will conduct a survey of employees of the Bechtel Corporation, looking at specific reasons why safety procedures are not followed and why accidents occur. The information obtained from the survey will provide insight into the reasons why accidents occur and provide useful information as to how to improve compliance and safety records for the company.

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Acknowledgements

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I would also like to thank my wife Richale, my son Kyle Jr., and my family for their love, support, and inspiration that has helped me to achieve my accomplishments throughout my career.

Kyle Quinn

Chapter 1

Introduction

The construction industry is the second highest category for nonfatal injuries and illnesses reporting 5.9 instances for every one hundred workers according the bureau of labor (Bureau of Labor Statistics (BLS), 2009). The Labor Bureau also states that although fatal injuries have declined in the construction industry for the year 2007, the construction field continues to incur the greatest number of fatalities of any industry in the private sector. The construction sector has held this title for the last five years. Of the three major subsectors within construction, fatalities among workers in construction of buildings actually rose 11 percent from 2006, with most of the increase in non-residential construction industries (BLS, 2009). This project will investigate if work related injuries can be attributed to employees who fail to comply with safety procedures.

There are different attitudes and responses to newly implemented safety program, and often they are not well received, which can negatively impact the personal safety of employees. New safety programs include training for technology and updates to existing occupational safety guidelines as demanded by the industry. Time constraints and other extenuating circumstances make it seem less beneficial to follow the guidelines. Research for this paper focuses on the reasons why construction workers fail to comply with safety guidelines. Results show that different attitudes and behaviors are present in today's construction job sites. This project will review current procedures and programs available help ensure employee compliance and to help limit work place injuries. An aggressive approach to work place safety will provide companies with the peace of mind that their employees are performing tasks according to protocol and will also significantly eliminate the risk of fatality and injury.

Statement of the Problem

The numbers of workplace injuries in the construction industry are too high and companies are negatively impacted by on-the-job injuries. Possible causes for high occurrences of injuries can be attributed to the attitudes and behaviors of craft workers in the US construction industry. Overall, the attitudes with regard to safety and safety procedures are viewed with a negative connotation. Another contributing factor is that safety procedures are not being implemented in the most efficient manner in today's construction sites. Many workers refuse to take part, both consciously and unconsciously, in safety activities. This puts both themselves and others at risk. The safety record of the construction industry has significant room for improvement.

One of a construction projects greatest task is to complete a job without injuries or casualties. The construction industry as a whole reports the second highest nonfatal injuries according to the Labor Bureau and has held this less than desirable title for the last five years (BLS, 2009). The Bureau also reports that fatalities are on the rise in non residential construction by 11 percent. This creates a significant problem for construction companies, because injuries and fatalities are not only extremely costly in terms of workers compensation claims, but also the catalyst for lawsuits that can cause significant expense and in some cases the demise of an organization. In order to become successful in preventing workplace injuries there are certain aspects that the management and the craft must pay close attention to.

One common mistake made in the construction industry occurs when employees put production before safety (Van Brink, 2006). This creates an environment where workers are rushed resulting in forgetfulness and negligence. This combination creates a recipe for injury. In most circumstances, these injuries are minor but occasionally they can be deadly. There are

many issues that contribute to the high number of injuries that occur in the construction industry. Some potential causes for a poor injury record are negative attitudes towards safety procedures, a lack of a reward system for participating in safety mechanisms, poor safety compliance and lack of disciplinary action for non compliance (Jaselskis, 1996). There has been significant research that looks at the many precautions that can be done to prevent workplace injury.

Significance of the Problem

The lack of compliance with safety issues and procedures is worrisome because it puts companies at risk for many concerns such as increased costs, lawsuits, injuries, and quality mistakes. Expenses for disability and lawsuits resulting from injury can be catastrophic to a company, and can cause bankruptcy. Owners realize that the costs of injuries are ultimately reflected in the cost of construction (Gambatese, 2000).

Table 1-1: Average Cost of Construction Site Injury

Type of Injury	Job Costs				Estimated Liability Costs		Total Cost to Employer	
	Direct	Inflation	Indirect	Inflation		Inflation		Inflation
Medical Only	$520	$828	$440	$700	$240	$382	$1,200	$1,910
Lost Work Day	$6,900	$10,980	$1,600	$2,415	$16,500	$26,257	$25,000	$39,784

(Hinze and Applegate, 1991)

Frequent injuries can reduce the morale of the worker corps and cause dissatisfaction with their jobs. Safety issues also slow the timeline of a project, because the incident has to be investigated and thus must be a determination it is safe to continue working. This lost time costs the company more money. To reduce these cost safety procedures need to play a more important role in everyday work activities.

Purpose of the Project

The purpose of this project is to examine the reasons and circumstances in which construction jobsite accidents occur. This project aims to find answers to the questions of why safety procedures are ignored. This project will also look at the demographics, specifically including age, sex, and years of experience, of employees who most frequently are involved in workplace accidents. The objective is to determine the correlation, if any, between negative attitudes with regard to safety procedures and the occurrence of injury. This information will provide insight for improving procedures and in turn improving safety records. This project will answer a number of key questions including;

- What programs are currently in place at the job site?
- Which procedures do employees feel are important?
- Which do they feel is not important?
- Are there certain instances when safety procedures are intentionally ignored? If so why?
- Do they feel management is more concerned with safety or production?
- Do managers support the safety procedures currently employed by the company?

The purpose of the survey is to gain data that will develop and inform readers of ways to improve construction safety compliance in the construction field.

Assumptions

It is assumed that there is a problem with safety compliance at all construction workplaces. This seems to be a reasonable assumption based on the high accident rate in construction. Another assumption is that all survey participants know and understand the construction safety rules and regulations that are being utilized by the company.

Delimitations

Delimitations of the project include only surveying Bechtel employees which may show a bias of attitudes because of company policies. Other limits include that the survey was conducted in a small geographical area. All jobsites have Bechtel representatives on them and the only differences would be what Bechtel's role on the jobsite is. Some jobsites Bechtel holds the role of Construction Managers, whereas on direct hire jobs Bechtel acts as the General Contractor.

Limitations

Limitations are weaknesses or things that could cause problems with the researching. Some of the limitations that may occur during the research and writing of this project was getting accurate personal responses. When performing a survey throughout a jobsite people would rather or feel as though they need to drive/strive to higher productivity. For example an iron worker that is supposed to be 100 percent tied at all times while walking steel decided it is faster to unhook their lanyard from one girder and connect it to the next when they are suppose to have two lanyards and when one is hooked you may then disconnect the other. Yes, it may be quicker but it is not as safe and the iron worker may think of this as an inconvenience so on a survey would answer more towards a productive side than a personal safety side.

Chapter 2

Review of Literature

There has been significant research with regard to safety in the construction industry and many studies suggest there is a problem with the number of occurrences of severe or fatal injuries at the workplace. Research shows that incentive programs and management involvement can help reduce the number of injuries a company reports, but doesn't look at the cause of the problem. The purpose of the proposed research is to examine why the construction industry continuously reports such high numbers of injury. Research will focus on the behaviors of construction workers in the US and determine the factors that most influence their behaviors. This data collection will hopefully provide important insight in the minds of the construction worker and indicate factors that may help to reduce the number of injuries reported in the future. Research focusing on management roles in safety, safety incentives, and safety strategies are discussed below.

Safety procedures were reviewed with regard to attitude, compliance, and specific means of implementing safety programs. This universal issue is not limited to the construction field, and therefore neither was the background research utilized for this paper. Background information was derived from both construction based safety research and research on general safety at the workplace. Management's role in safety was another important area in which data was collected to develop a review of literature. The plethora of research that is available on safety and the means of improving safety clearly identifies that the poor safety records are a significant problem in the industry. Investigation for the improvement of safety at the workplace is extremely valuable for businesses and corporations regardless of size.

Management Role in Safety

Management involvement is essential to improving safety on construction jobsites. A case study by Zohar (1980) reports the findings of a test which was performed when a group of people came and observed a jobsite and how it was operated. The workers on the jobsite were interviewed regarding the safety practices that where currently being utilized by the organization. The results indicated that the management was not actively involved and on board with safety. By making a few suggestions and slight changes such as a monthly safety meeting, having workers come into the manager's office and discuss safety concerns, and just capitalizing the importance of safety can markedly reduce the number of work injuries resulting from unsafe behavior.

New supervisor intervention, as discussed by (Zohar, 1980), analyzed five specific categories including;

- information exchange wherein the purpose is to communicate explanations, warnings and general information
- directive exchange which entails direct orders or instruction
- corrective exchange which focuses on mistakes and deviations from common practice
- supportive exchange which is communication that encourages and rewards positive behavior
- inquisitive exchange which promotes the learning of new information

Information gathered showed that most exchanges were related to more than one topic. For example, conversations generally discussed both safety and productivity simultaneously. The authors of this case study indentified that it is easier to change a small group of people who are

more invested in the company than it is to try to change the role of a core of workers (Zohar, 1980). By modifying the supervisor's role in the safety procedure and encouraging them to more frequently interact in the five safety categories listed above, it will in turn give the impression that safety is as much of a priority as quality or productivity, which are often the main focus of supervisor/employee interactions.

Safety Strategies

Research has also focused on specific strategies for achieving higher standards of safety performance in the construction industry. There is a need to improve safety factors and performance due to the high rate of injuries in the construction field. Occupational Safety and Health Administration (OSHA) and Experience Modification Rate (EMR) are useful tools in evaluating a company's safety measures and records. EMR is an important indicator for understanding the quality of safety strategies because it shows an actual dollar amount for money paid to injury claims for specific businesses (Jaselskis, 1996). EMR is calculated by taking the ratio between the dollars amounts of adjusted actual claims filed to the amount of anticipated claims for a type of construction expressed as an average over a three year period (Jaselskis, 1996). This provides a quantitative measure for safety occurrences. OSHA also provides quantitative measures for evaluating safety implementation of companies. Specifically, they utilize equations that provide concrete data in areas such as lost time incidence rates, severity rates, and recordable incident rate. Other qualitative measures can be used to determine a safety assessment; however, these issues are subjective and include questionnaires and assessment of a safety by a third party. The article "Strategies for Achieving Excellence in Construction Safety Performance" developed survey collecting information about the companies of various sizes and types, the questionnaire gathered information about the companies safety programs, and

quantitative data including EMR and OSHA ratings (Jaselskis, 1996). Results indicate that the length of years of operation was directly correlated to the EMR rating. The findings indicated that the longer the company was in existence, the better the EMR results (Jaselskis, 1996). The data gathered showed that there was no relationship between company size and EMR. This information would lead one to conclude that experience not size is relevant to the EMR. The data collected also showed a correlation between EMR and quality safety programs. The companies who reported lower EMR also proved to have higher standards with regard to safety programs and implementation of safety programs. Revenue spent on safety programs also directly related to the number of reported injuries, higher revenue correlates to lower injury figures. General findings indicated that the utilization of a safety coordinator lowers injury incidences. The companies with better safety performance had more involved safety related programs and the number of safety meetings and alcohol and substance testing programs relates to injury rate.

Safety Incentives

Safety is a concern for everyone and therefore companies have developed incentives to help ensure that employees follow safety protocols. The research article published in "Construction Management and Economics" discusses the effectiveness of incentive programs in the U.S. Construction industry (Tam, 2001). The US Bureau of Labor Statistics' Census of Fatal Occupational Injuries (CFOI) collects data related to deaths and traumatic occupational injuries in the U.S. Their data indicates there were 10.9 fatalities for every 100,000 construction workers (See Figure 2-1).

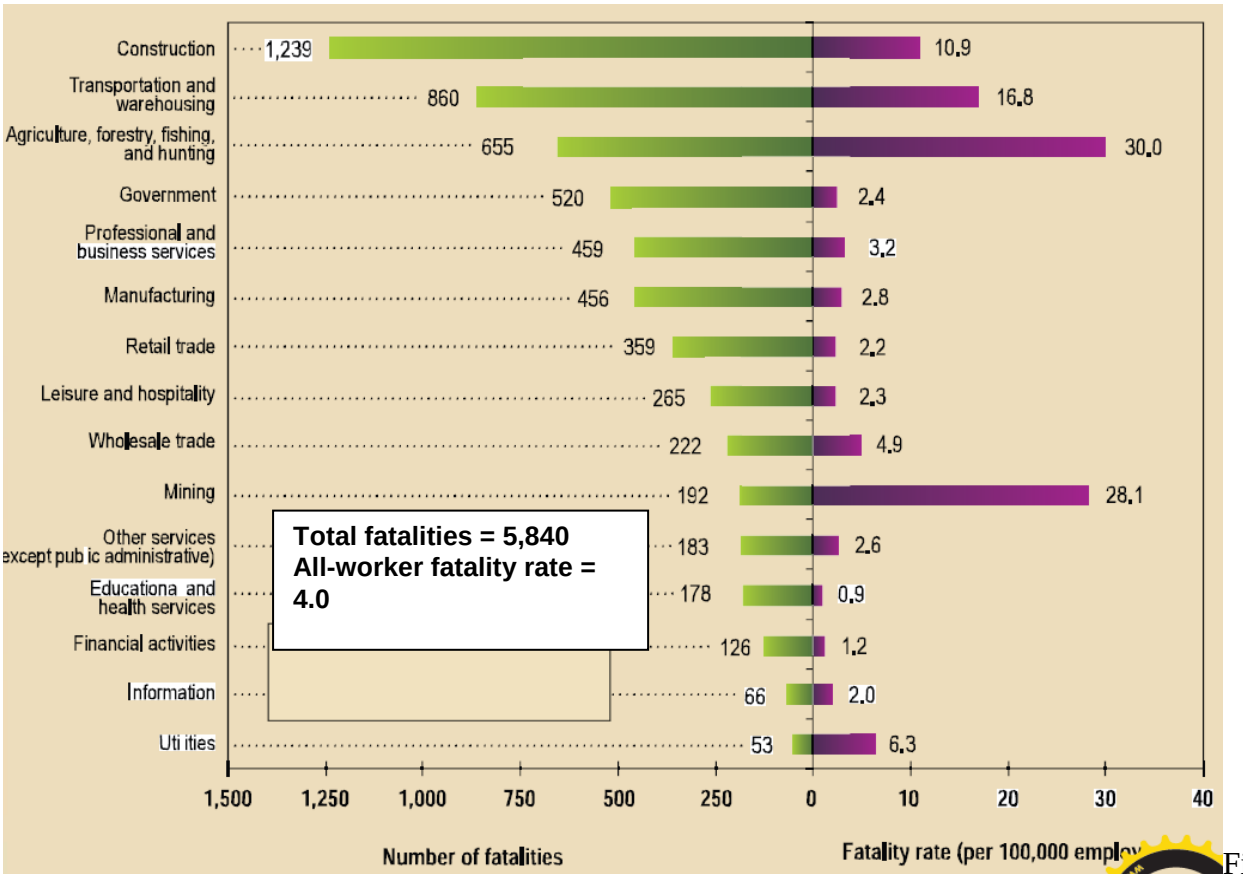

Figure 2-1. Number and rate of fatal occupational injuries, by industry sector (BLS, 2009)

Although the statistics have improved dramatically in the 1990's, accident rates in the construction industry are still 50 percent higher than that of all industries, lagging all industries by about 10 years (BLS, 2009). An alarming fact is that the number of injuries in the construction industry has increased in the past decade (see Figure 2-2).

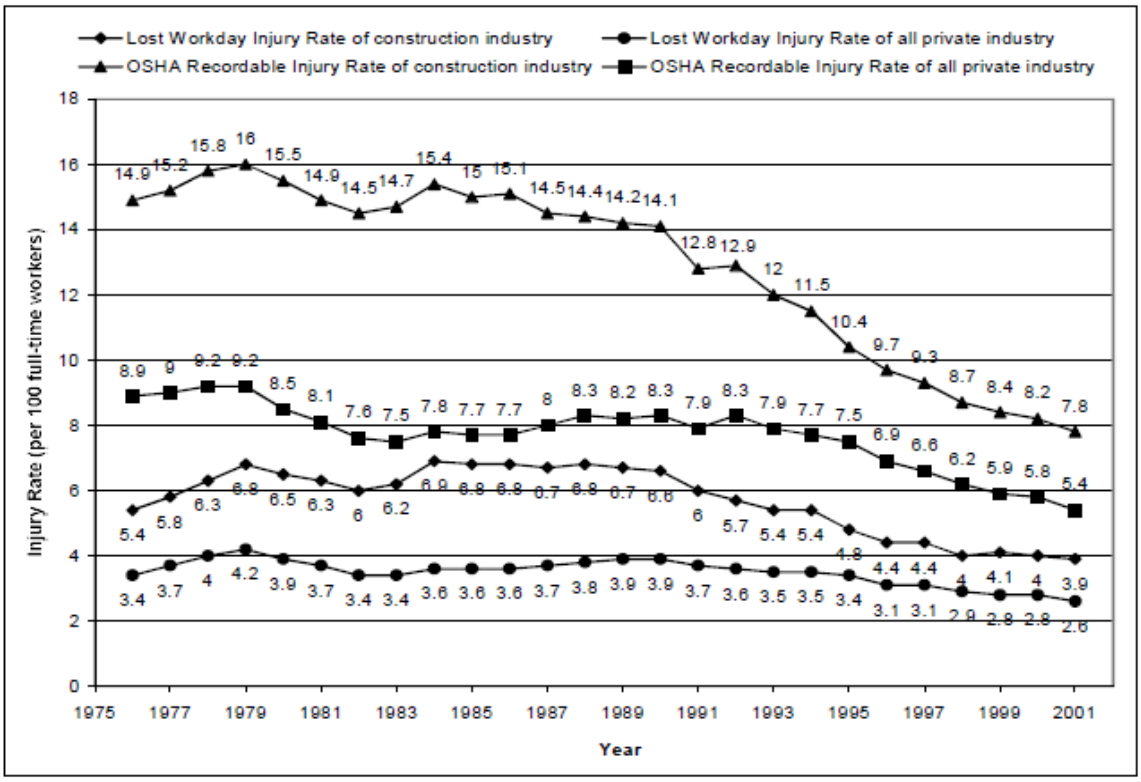

Figure 2-2: Injury rate of construction and all private industry (Gangwar, 2005).

According to the authors Gangwar and Goodrum (2005), workplace injuries are lower and less lost time reports are found in those companies who offer incentives to follow safety programs. There are a number of incentive programs currently offered in today's workforce and these are generally categorized into two types, injury based or behavior based programs (Gangwar, 2005). Injury based programs offer reward programs for avoiding injury or for achieving a certain period of time injury free. One disadvantage of this type of program is that it can provide encouragement for workers to not report workplace injuries because of the incentives offered by the company. Often, injuries are a combination of several factors and are not always due to employee negligence. If an accident occurs due to extenuating circumstances, employees can be disgruntled when incentives are denied. Behavior based incentive programs

are based on observation of job performance. If employees follow company guidelines, such as attending safety meetings, participating in safety training, reporting safety issues, and properly using equipment, they are rewarded with incentives for their good behavior. The negative issues with behavior based incentives are that it is more subjective and harder to gauge the amount of participation. Just because an employee attends a safety event, does not mean that the employee is internalizing and utilizing the information provided. Also, it has been found that behaviors can frequently change due to factors such as changes in equipment, facilities, or even management (Gangwar, 2005). The findings of this research on incentive programs suggests that incentive programs do improve injury incidences, but behaviors change over time and incentive programs become less effective over time. In order to combat this finding, companies should examine their incentive programs often and update them so that they remain effective over time.

Chapter 3

Research Methodology

Previous research and studies failed to look at the sociological and behavioral reasons why safety non-compliance occurs. The objective of the study is to examine the reasons why accidents occur and why construction workers sometimes choose to ignore safety procedures.

Method for Data Collection

Data collection for the proposed project included a detailed survey (Appendix A) conducted on a Bechtel, Inc. jobsite. The data collected was aimed at finding answers regarding current safety compliance and noncompliance issues in the construction industry. The selected jobsite was the McCarran International Airport Project located in Las Vegas, Nevada. The pool of participants was selected from a random group of Bechtel employees. The method employed to conduct the study included the development of a detailed survey. The survey was designed to examine specific behavioral factors of construction workers with regard to construction safety. The survey design included several reviews to ensure that the survey was correctly targeting the issues related to the present research study. The survey included twelve short questions so that the respondents would be engaged and provide honest answers. Lengthy surveys create inaccurate answers and unresponsiveness (Survey Monkey, 2010). The questions were written generally so that respondents would comprehend the questions and be able to answer accurately. Respondents were also allowed to answer at their own convenience rather than in a predetermined period of time; this method was also employed to increase responsiveness. The survey included both open and closed ended questions. Open ended questions are more difficult to analyze but aid in eliminating interviewer bias (Baker, 2003).

Justification

This study is aimed at determining the reasons associated with safety related accidents and safety non-compliance in the construction field. In order to gain an understanding of the behavioral and psychological reasons associated with safety accidents it was necessary to collect data from the construction workers who are active in the field of construction. A questionnaire is effective in a variety of research situations and provides quantitative data on past and present attitudes, behaviors, opinions, respondent variables and knowledge (Baker, 2003). A survey also allows for the benefit of statistical and numerical measurement and was the most cost and time efficient means for data collection for this study. Examining the attitudes that are associated with safety provided insightful data that reflects the thoughts and feelings of employees with regard to safety. The analyzed data provides important information to improve safety procedures and compliance within the Bechtel organization and other construction companies.

Description of Data Collection

Permission from Bechtel's human resources department was required in order to present the survey to Bechtel, Inc. employees. The survey was reviewed and approved by Purdue Institute Review Board as shown in Appendix B. A hard copy survey was sent to 176 potential respondents. A hard copy format was required since an electronic survey was prohibited by Bechtel human resources. The respondents at the time of the survey were all currently employed by the Bechtel organization and were from all sectors of the business, including field engineers, project managers, project controls, quality assurance, and clerical staff.

Bechtel's role on this particular jobsite is to act as construction managers. This means that the respondents at the time of the survey were not active in the field as far as hands on labor. The role of employees at the McCarran International Airport project is to oversee, inspect and

evaluate progress. However, a large majority of the employees that make up the Bechtel work force at this jobsite have held positions in the past (on other Bechtel jobsites) where they have acquired hands-on experience in the field. This is important fact to establish, since it shows that the respondents have had a direct relationship to safety in the field during their careers in the construction industry. The range of jobs held in the past by the respondents varies greatly and include but are not limited to: welders, iron workers, carpenters, millwrights, and sheet metal workers. The survey was returned anonymously, so it is impossible to ascertain the specific numbers of workers from each job category. However, it is noted that the survey was only distributed to approximately 5 -7 clerical staff workers. The rest of the distributed surveys were amongst the members of upper level management, field inspectors, quality control staff, and the members of project controls.

Respondents were briefly informed on the purpose of the survey, such that the survey was anonymous and voluntary and will not affect employment. The respondents had to be at least eighteen years old and were and instructed to fill out the surveys accurately and honestly. All the surveys were returned into a box located in two different locations. After the survey was executed, the survey responses were collected and tabulated and the information was transferred to statistical survey software.

Chapter 4

Description of Data

The study included demographic information and key questions relating to safety compliance. One purpose of the survey was to determine if the employees are accurately aware of current company safety procedures. Specific questions on the distributed survey examined the attitudes of employees with regard to safety and were directed towards compliance with current safety procedures, identification of what incentives and repercussions would be most effective. The survey asked questions regarding programs that would motivate them to comply with safety procedures. The aim of the survey was to examine and compare demographic information of respondents with psychological and behavioral reasons related to safety procedures. The survey also examines the respondent opinions on effectiveness, understanding, and satisfaction with safety related training.

Data Analyses

Analysis of the data obtained from the electronic questionnaire survey to Bechtel Construction employees used multiple variables to provide vital information regarding safety issues within the organization. The survey was mailed to 176 potential respondents and had a response rate of 65 percent. In the first stage of data analysis, software systems were utilized to show the demographic information of the respondents.

The respondents were broken down by age categories from 18–50 plus. The graph in Figure 4-1 shows the breakdown of the different age groups that participated in the survey. The totals state that 46.5 percent (53) of the participants were 50 or older. The next group was the 41-50 age groups at 21.9 percent (25). The 31-40 age brackets came in third at 18.4 percent (21)

followed by the 26-30 age groups at 7.0 percent (8) and finally the lowest age group was 18-25 at 6.1 percent (7). This is consistent throughout Bechtel organization.

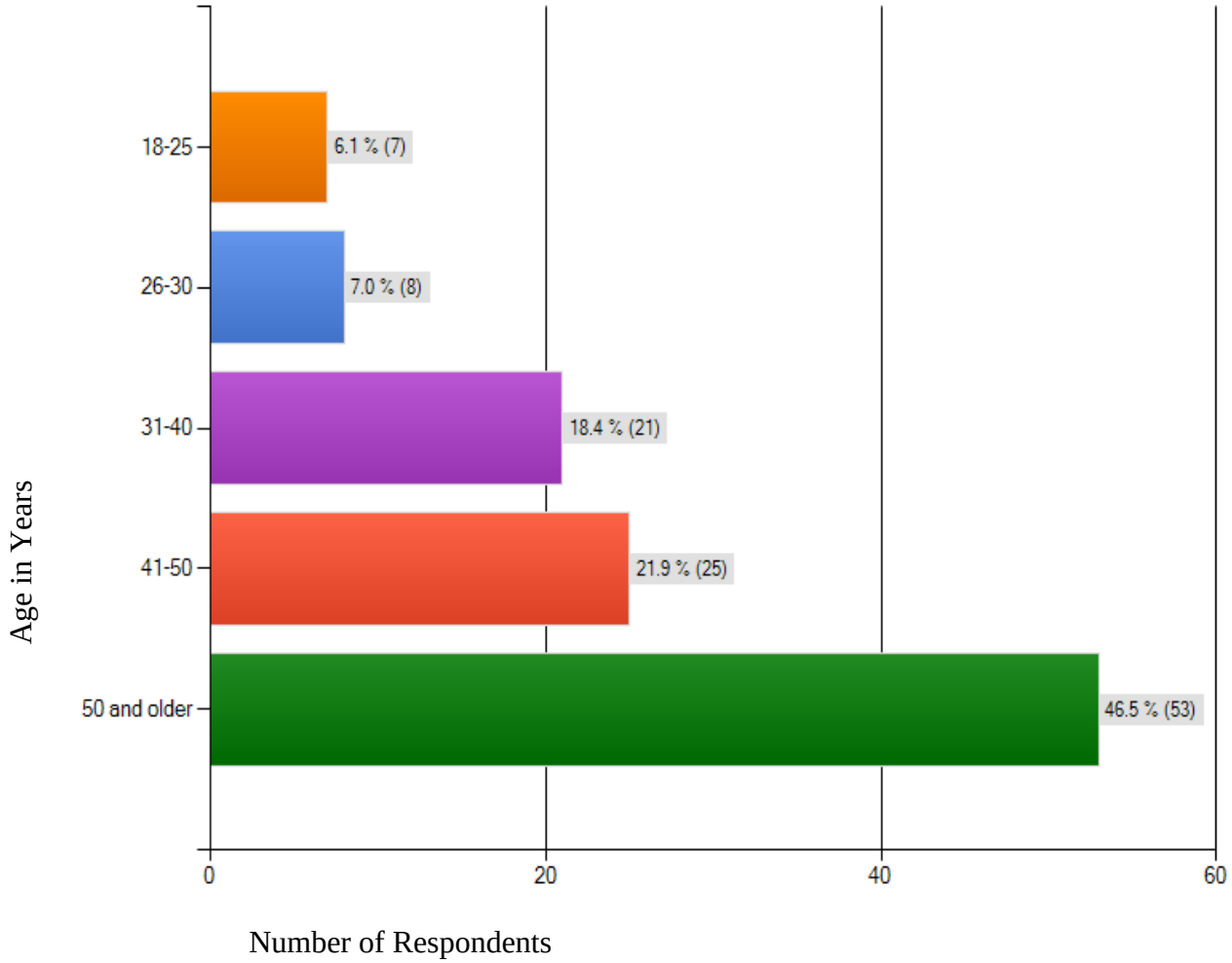

Figure 4-1: Age Category

As shown in Figure 4-2, the majority (66.1 percent) of the survey participants had 10 or more year's experience and 15.7 percent had 1-3 years experience. The group having 3-5 years experience made up 8.7 percent of the respondents. The final two groups were 7-10 years experience at 5.2 percent and 5-7 years at 4.3 percent.

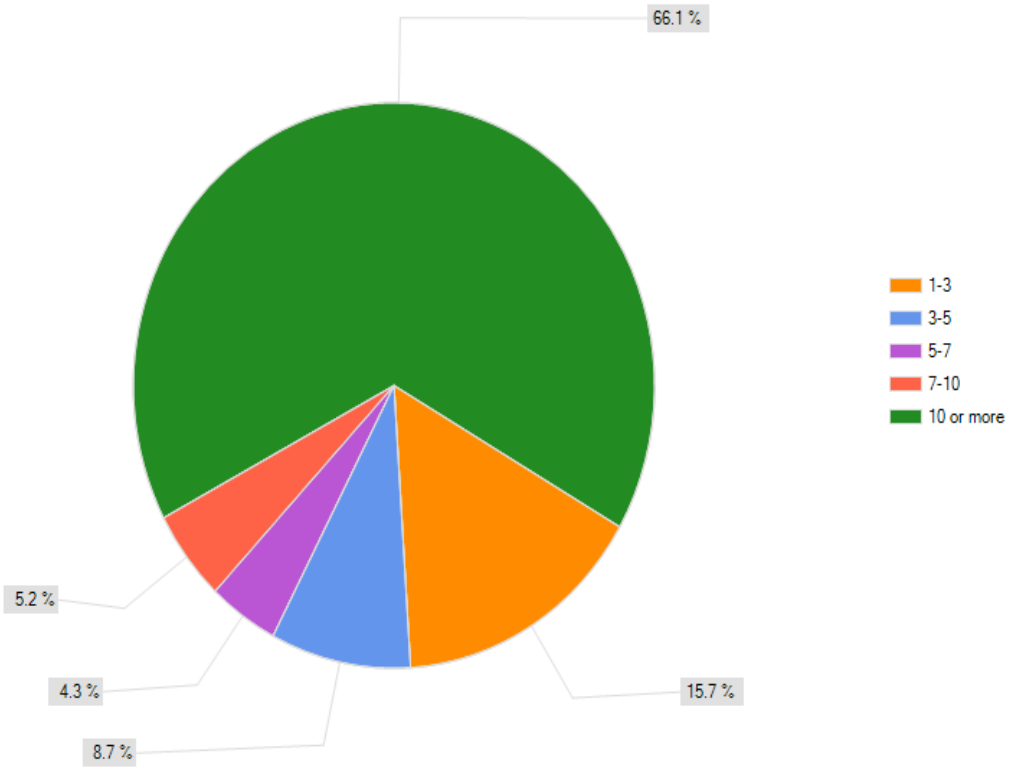

Figure 4-2: Years Experience

Figure 4 -3 looks at the correlation between the age of respondents and years experience. The largest number of respondents had more than 10 years of experience and were in the age groups 41 – 50 and 50 and older.

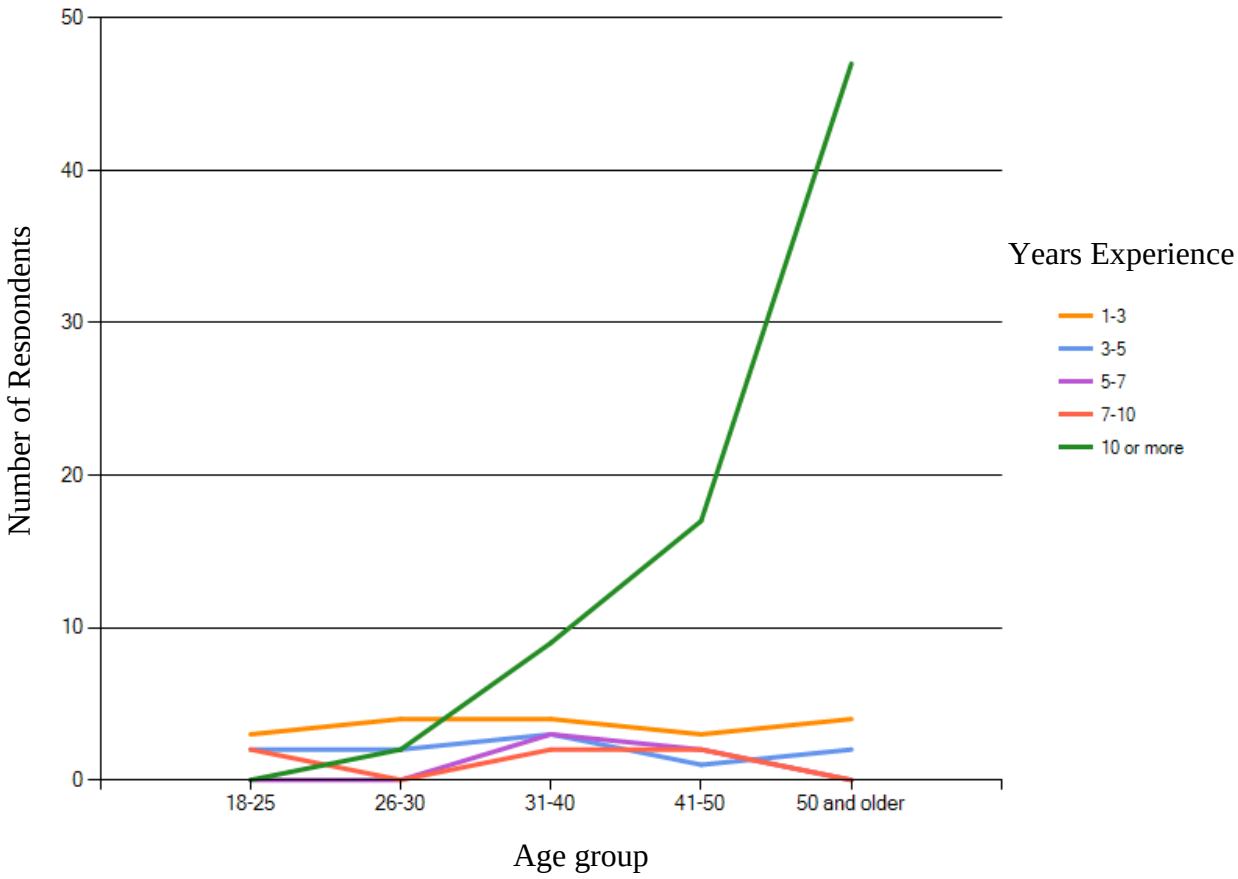

Figure 4-3: Age and Years of Experience Correlation

Of the 176 respondents, there were twice as many male participants at 67.8 percent (78) than there were female at 32.2% percent (37). This is typical for the construction industry. (See Figure 4 -4)

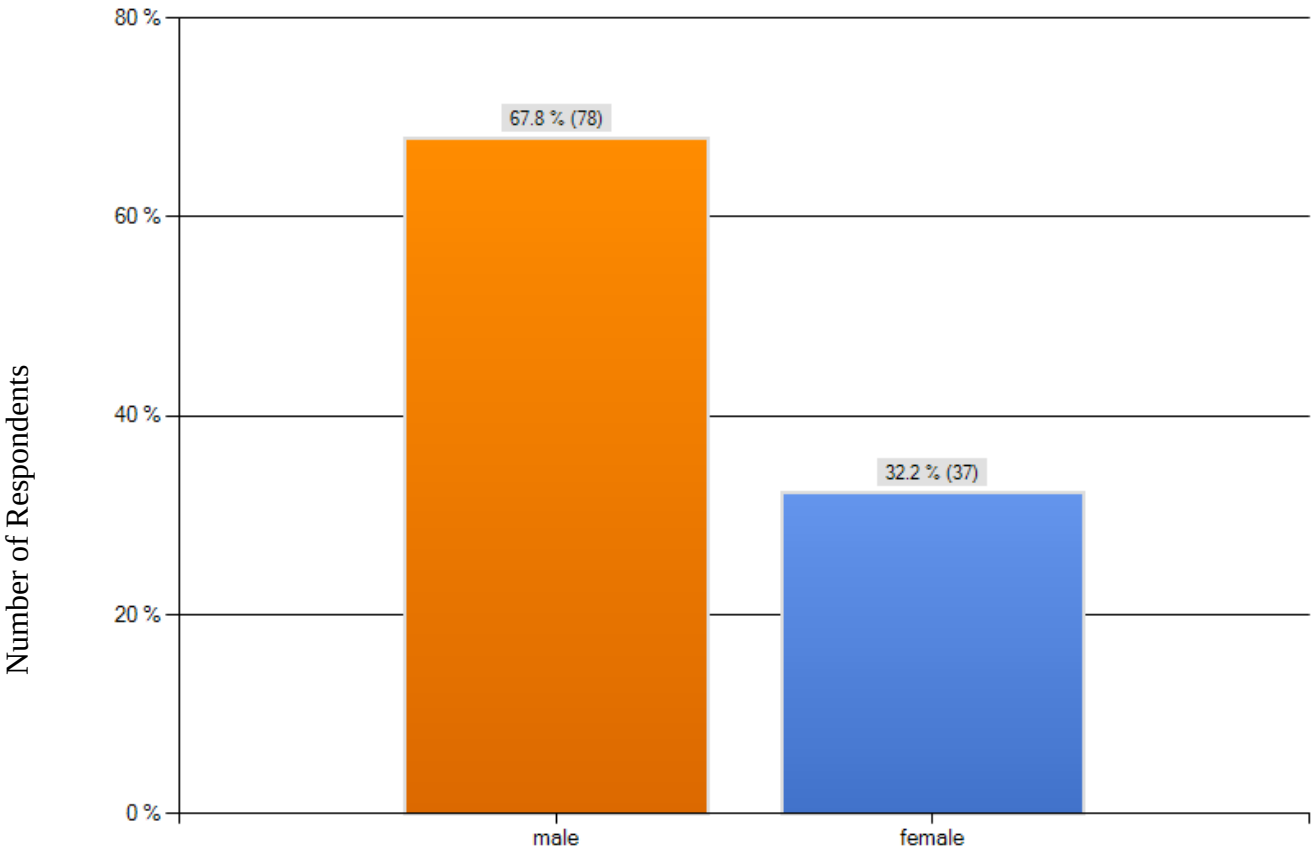

Figure 4-4: Gender

A large majority of respondents believed that their safety training was very effective with respect to their job activities and almost half of the respondents felt that the training they received was effective. Only 2.7 (3) percent of respondents felt that the safety training given by Bechtel was less than average. As shown in the bar chart, Figure 4-5, 46.5 percent (53) of the participants agreed that the safety training was very effective. Of the 115 participants 40.4 percent (46) agreed the safety training was effective. The remainder of respondents felt that the training was average with a 10.5 percent (12) response, somewhat effective with 1.8 percent (2) of the response, and non effective having 0.9 percent (1) of the responses.

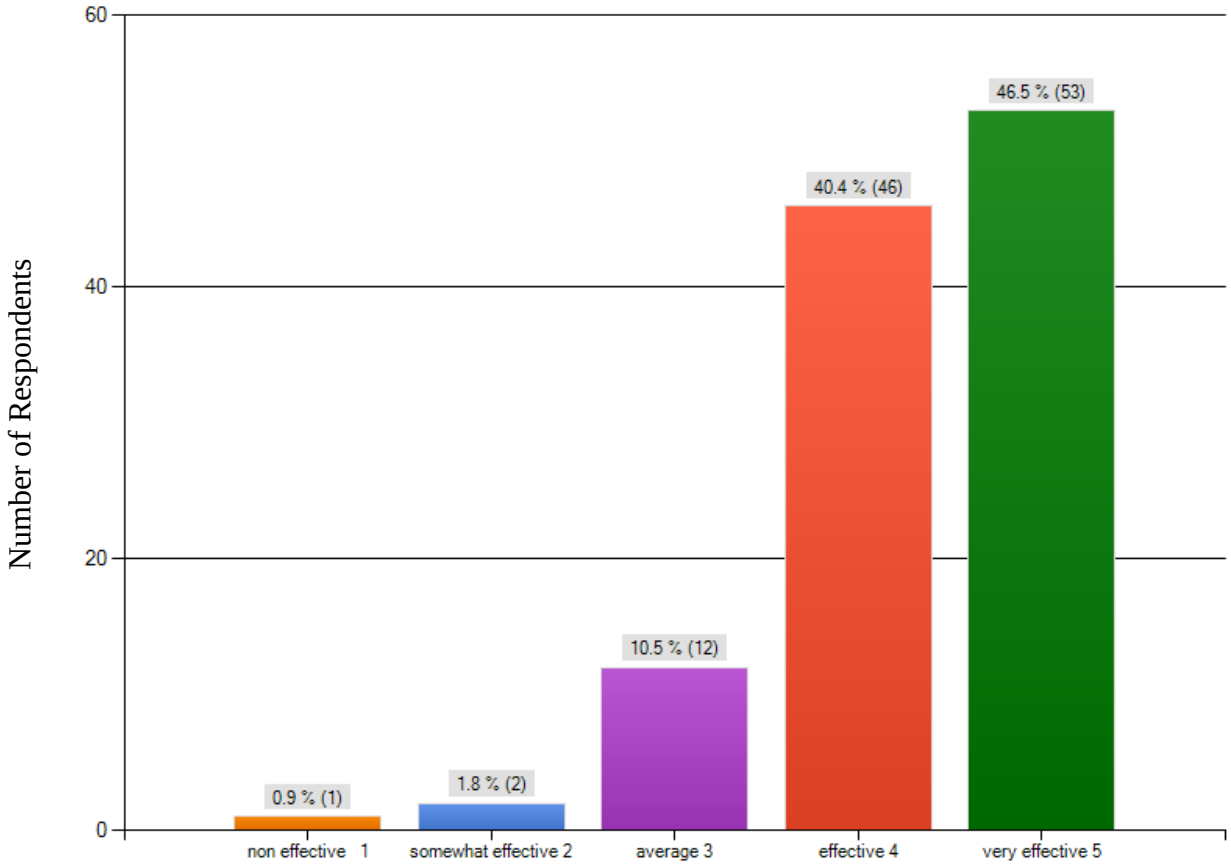

Figure 4-5: Effective Training

The respondents were asked to indicate if they were well informed about all safety regulations applying to their daily activities. As shown in the pie graph (Figure 4-6), 93 percent of the participants agreed on yes. Only 7 percent of respondents felt that they were not well informed on safety regulations.

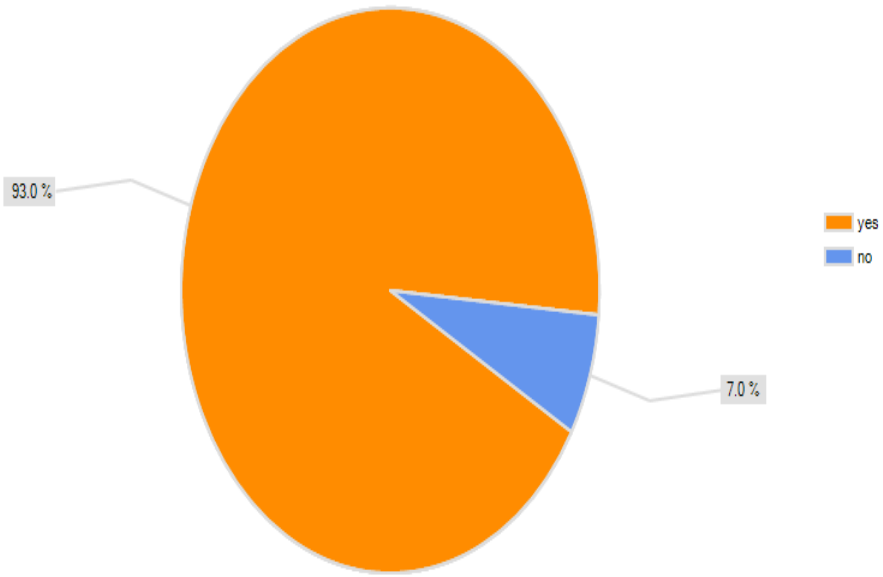

Figure 4-6: Awareness of safety regulations

As shown in Figure 4-7, 84.3 percent of the people said that they do follow safety regulation, in every circumstance. Whereas only 15.7 percent of the respondents indicated that there were some instances where they did not feel that following safety guidelines was necessary. The 15.7 percent of respondents who believed safety procedures did not always need

to be followed were asked in what context it was okay to ignore the regulations. All 18 respondents gave reasons for ignoring regulations. The answers for this follow up question varied among five categories. 22 percent of the respondents indicated that convenience and ease was the largest contributing factor for ignoring safety protocols. Another 22 percent of respondents said that they forget about safety regulations or don't realize that they were in noncompliance until after the fact. Lack of time was a contributing factor for 16 percent of the respondents. The remaining respondents were equally distributed (11 percent) among the following categories; not informed, the right equipment was not available, texting/talking on cell phone while driving.

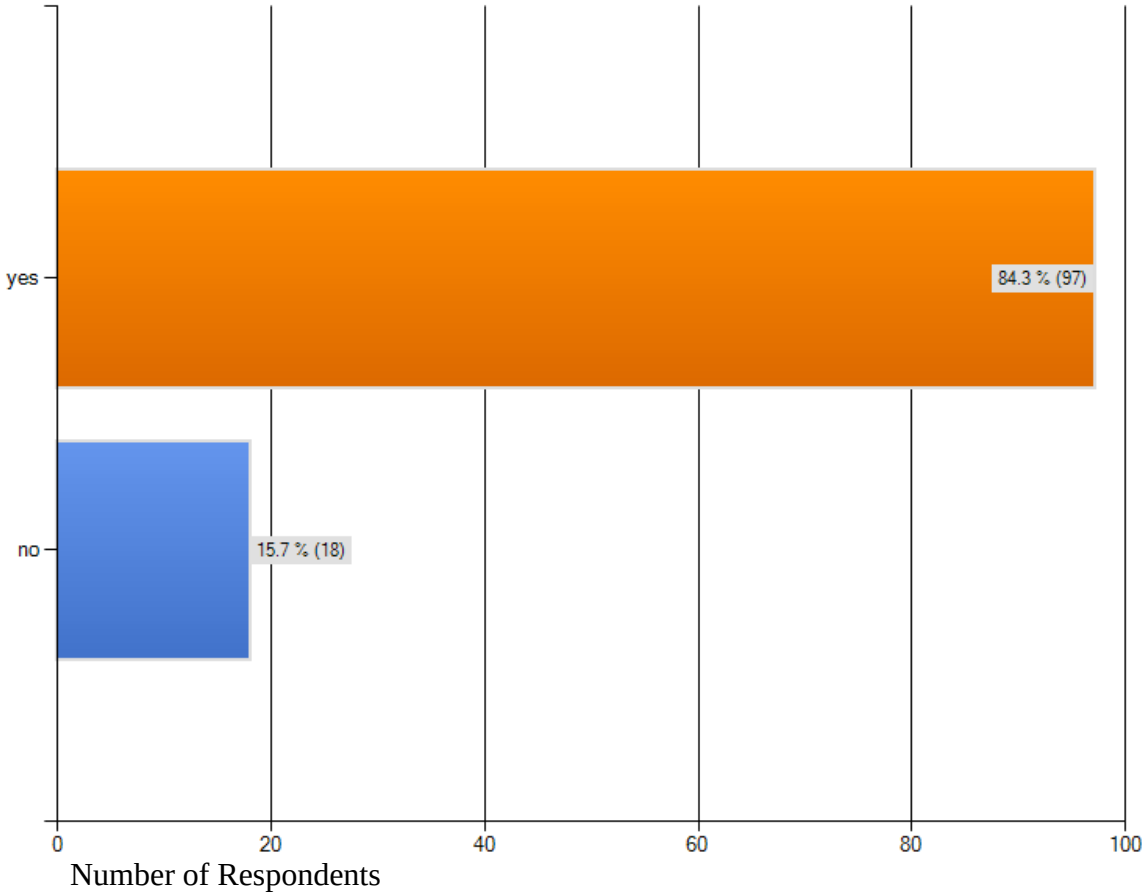

Figure 4-7: Always follow safety regulations

The survey results indicated that 49.5 percent of respondents have been in or have witnessed an accident on the construction jobsite at some time in their career. As shown in Figure 4-8 there were slightly more no responses than yes responses.

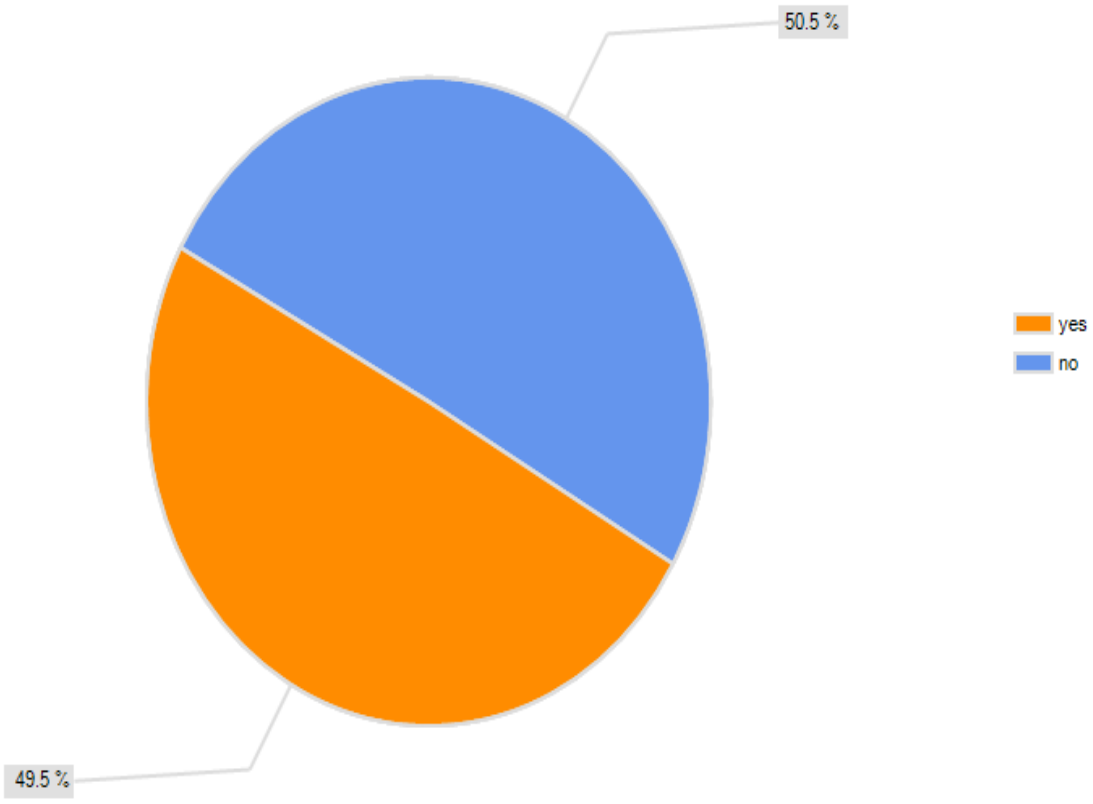

Figure 4-8: Involved or witnessed an accident on jobsite

Of the 49.5 percent (55) who said they were involved in or witnessed an accident, 82.5 percent (47) of those respondents indicated they were witnesses and only 21.1 percent (12) indicated they were involved personally in a work related accident (See 4-9).

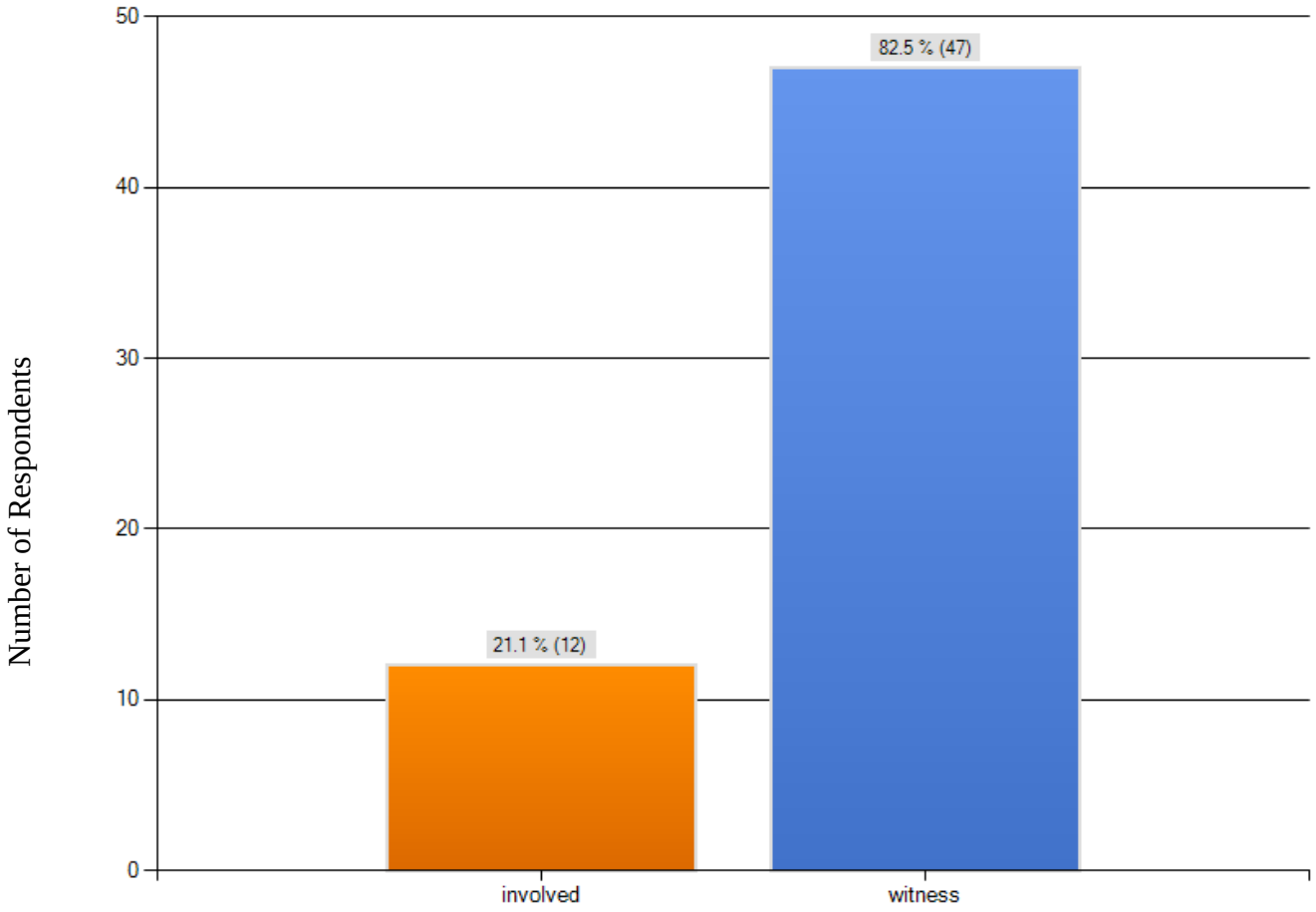

Figure 4-9: Involved or witness

The 49.5 percent who said they were involved or witnessed an accident were asked to further identify the cause of the accident that they were involved in or witnessed. The most common response indicated at 56.3 percent (27) for cause of accidents was lack of attention or

awareness. Failure to properly use equipment, failure to acknowledge safety regulations, and failure to use machinery properly received 8 responses (16.7 percent) as shown in Figure 4-10.

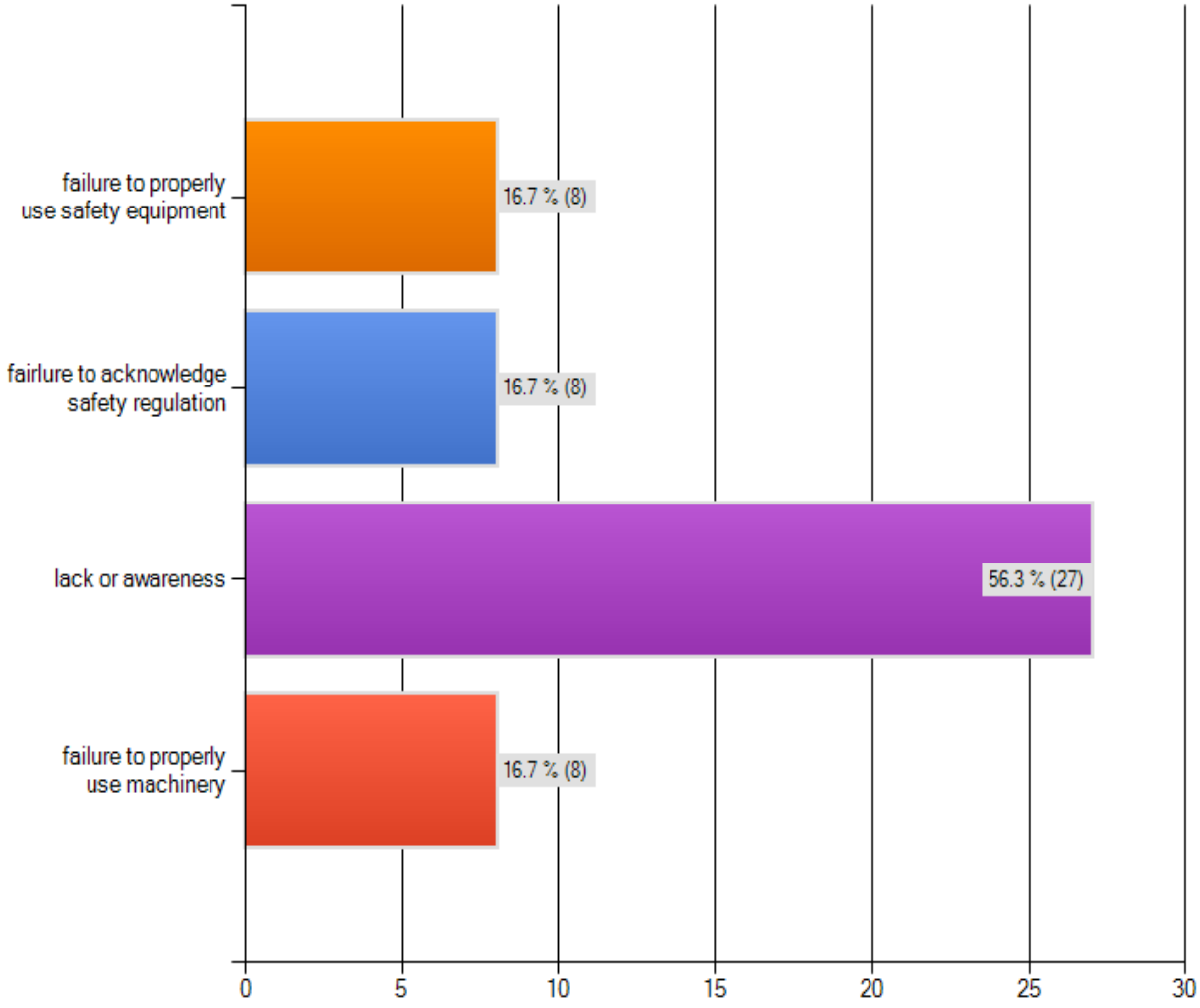

Figure 4-10: Cause of Accident

As shown in the pie graph below (Figure 4-11), 99.1 percent of the participants agreed that you should always follow safety regulations and only 0.9 percent said it is not necessary to always follow safety regulations.

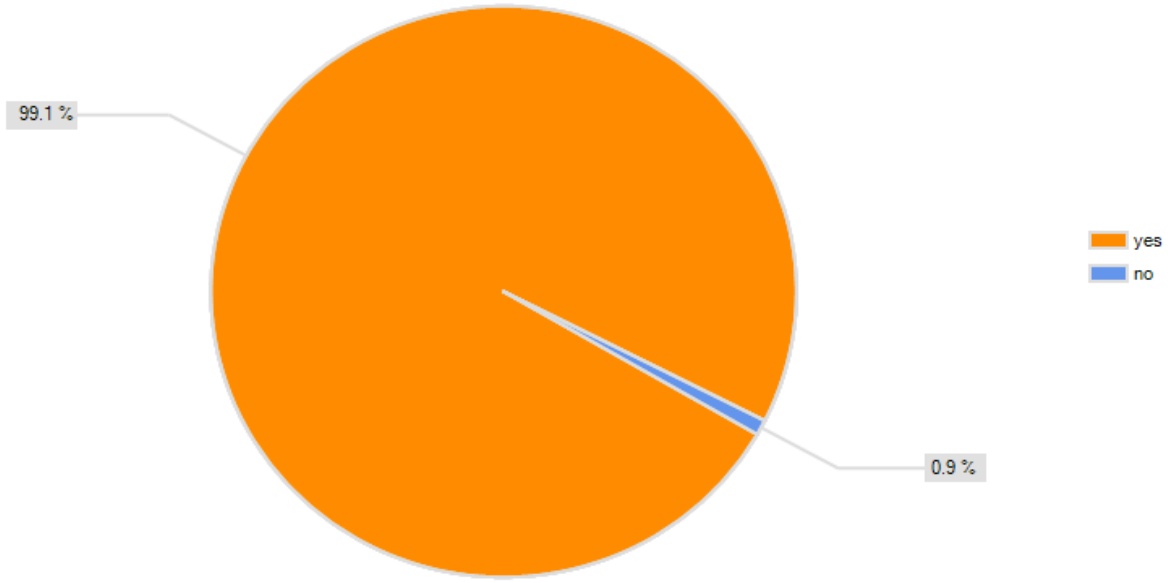

Figure 4-11: Always follow safety regulations

In the second stage of analysis, multi-variable statistical methods were conducted using software to find the relationship between safety performance and year's experience. There were 21 percent of respondents who were personally involved in a construction related accident. Of those 21 percent, more than half (58 percent) of them had more than 10 years of construction

experience. The other 42 percent of respondents involved in an accident had only 1-5 years of construction experience. A large number of respondents indicated that they had witnessed a work related accident in their years of experience. The more years experience, the more likely the respondents were to have witnessed a safety related accident (See Table 4 -1). The respondents who had 10 or more years experience made up 78 percent of the surveyed accident witnesses.

Table 4-1: Years experience correlated with accident involvement

Years Experience	1-3	3-5	5-7	10 +	Response Totals
Involved	4 (33%)	1 (8%)	0 (0%)	7 (58%)	12
Witnessed	3 (6%)	2 (4%)	1 (2%)	37 (78%)	47
Totals	7 (12%)	3 (5%)	1 (2%)	54 (92%)	59

In the results that have been gathered pertaining to the safety motivator, respondents were asked to rank each category from 1 -5 (1 being the highest and 5 the lowest). It has been identified that fear of injury, with 89 responses, is the leading reason in why people chose to follow safety regulations. Desire to follow rules was the second highest ranked factor in why people follow safety regulations having 49 responses. The neutral reason of why people follow safety regulations is fear of reprimand with 32 responses. Supervisor praise is the second to the last (39 responses) and promotion was ranked last (60 responses). The data regarding motivating factors for following safety regulations can be found in Table 4-2.

Table 4-2: Motivators for Safety Regulation

What motivates you to follow safety regulations?						
Scale	**Most**				**Least**	
Answer Options	**1**	**2**	**3**	**4**	**5**	**Response Count**
fear of reprimand	5	14	**29**	16	26	90
supervisor praise	0	5	27	**39**	18	89
fear of injury	**89**	14	2	0	2	107
desire to follow rules	28	**48**	16	2	3	97
promotion	1	1	6	25	**60**	93

The survey also examined the relationship between years experience and how well informed employees believe they are. Those people who responded that they were well informed about the safety regulations fell into the category of 10 years or more in construction experience. 107 people said that they were well informed about the safety regulations that applied to their work; however, 21% indicated that they had been personally involved in an accident. Of those people that were involved 50% were older than 50 and had 10 or more years experience. The majority of people (77.8%) that were in accidents attributed the cause to lack of awareness.

There were 99 respondents who rated safety training at Bechtel as effective or better. Of those 99 respondents, 49.5 percent have either been involved in or witnessed a safety related accident with the same organization. Of these respondents 56 percent attributed the cause to lack of awareness. The second category, having 20 percent of responses, was failure to properly use safety equipment. Other reasons that were indicated for cause of accidents included equipment failure, improper procedure, and lack of supervisions. 67 percent of respondents involved

personally in workplace accidents were male and 92 percent indicated that they always follow safety regulations and 83 percent indicated that they felt their training related to their everyday work activities were effective or better.

72 percent of male respondents indicated that they do not always follow safety procedures. 83 percent of respondents who do not always follow safety procedures had 10 or more years experience in the construction industry. Those people who indicated that they do not always follow safety procedures gave many differing reasons as to why safety procedures are not always followed.

Reasons indicated for not following safety procedures:

- Schedule came before safety on the project
- Lack of proper preparation, hurrying
- Habitual texting while driving
- Sometimes the work conditions do not allow for safety procedures to be followed
- Sometimes it is quicker and more convenient to avoid safety regulations
- Safety regulations are updated frequently and not always informed on the latest regulations
- Unintentional
- Haste, in a hurry to complete task

Those people who do not always follow safety regulations indicated that they are most motivated by fear. 50 percent of those respondents who do not feel that it is necessary to always follow regulations have been involved in or witnessed a workplace accident. Of those 50 percent, only 5 percent have personally been involved.

Chapter 5
Discussion and Conclusions

The survey provided significant information regarding the ways that safety is perceived by the different age groups with differing years of construction experience. The results gathered that pertain to the safety motivator indicate that the fear of injury is the leading reason why people chose to follow safety regulations. Desire to follow rules is also a leading factor in why people follow safety regulations. The neutral reason of why people follow safety regulations is fear of reprimand. Supervisor praise is the second to the last and promotion is last. These results are not very surprising. They are basic textbook answer and are the answers that Bechtel drives and pushes for. Promotion was the lowest motivating factor for all ages groups except for those who had had 10 or more years of experience. The group having 10 or more years of experience was the most likely to choose promotion as a motivator. The majority of the people that chose fear of injury were 1-3 year experience category. This make sense because when you are new to the construction world you are not sure what you can and cannot do so you are scared of getting hurt. In fact, new and inexperienced employees are the most likely to be injured on a construction site (Hinze, 1978). Research has found that this statistic exists due to a lack of understanding and inexperience (Hubbard, 2009). After you are in the construction world long enough you figure out what will and will not hurt you and how you perform task safely so your mind set begins to develop into the "I'm not going to get hurt anymore" mentality, which could be a good and a bad thing. It is good because you have confidence but bad because you could get displacement. The veterans are not worried about getting hurt and they strive for promotions. These results are unexpected. Prior to the study, it was anticipated that the younger generation would have been more motivated by promotion and the older grouping would fear injury. The results that have been identified are understandable because the people that have been in the

construction world longer have more experience and understand the safety rules and regulations better. The younger, newer workers do not understand and probably do not agree with safety regulations because they have not seen how detrimental accidents can be to a project.

It was interesting that 49.5 percent of respondents have witnessed or been involved in a workplace accident, but 99.1 percent of respondents felt that they were well informed about safety regulations pertaining to their everyday work activities. It appears that although the workers feel that they are well informed about safety precautions related to the work tasks that has not prevented or eliminated accidents from occurring for almost half of the respondents. The results indicated that most respondents who were personally involved in a workplace injury fell into both the least and most experienced categories, 1-3 years and 10 or more years respectively. This result makes sense, because the more years of experience the more chances the worker has for being involved in an accident. However, in a perfect world the accidents should decrease as the worker gains experience and training to prevent injuries. Moreover, the more experienced employees are typically older in age and sometimes declining health may play into work related accidents. The category of 1-3 years experience was also most likely to be involved in a workplace accident. This result is expected, since this group has the least on-the job training, knowledge, and experience. This finding is consistent with other construction industries records (Hinze, 1978). Newer and younger workers are less familiar with training terminology and construction site conditions and are therefore less likely to benefit from safety training programs (Hubbard, 2009). This could be another attributing factor to why younger and inexperienced employees were found to be involved in the most accidents.

When respondents were asked what the behavior cause of the work related accident they were involved in or witnessed, an overwhelming number indicated that they felt the accident was

attributed to lack of awareness. This result is somewhat discouraging, because there isn't much safety related training or education that can teach a worker to be careful and aware during procedures. This does, however, indicate that increasing specific motivating factors may help increase awareness and prevent injury. This information is beneficial for management, so that they can stress the importance of awareness to their subordinates. It is always beneficial to understand why an incident occurs so that positive solutions can be achieved. Other responses included failure to properly use equipment, failure to acknowledge safety regulations, and failure to use machinery properly. These responses reflect issues that can more effectively be addressed by training and education.

Since lack of awareness or carelessness was the greatest attributing factor for accident causes, one would assume that the respondents would have a lackadaisical attitude towards safety regulations and training, since they don't feel that it's necessary to be alert while performing job functions. However, the opposite proved to be true. Approximately 99 percent of respondents felt that it is always important to follow safety regulations.

Since 99 percent of respondents thought that it was important to always follow safety regulations, it would make sense that a large majority would indicate that they do always follow safety regulations. 15.7 percent of respondents indicated that they do not always follow safety regulations. Of those respondents who do not always follow regulations, 50 percent have been involved in or witnessed a workplace accident. The results indicate that the involvement in a workplace accident does not make the worker feel that safety regulations should always be followed.

Recommendations /Further Research

There are several areas where this study could be modified to improve the efficiency for future research. If the study were repeated it would be more effective to send the surveys out via e-mail. Also, it may be beneficial to prompt participants to read the instructions carefully. There were several respondents who did not fill in the responses correctly. Specifically, issues related to the ranking of the motivating factors. In the future, this question may be edited to make the ranking system more clearly defined to the survey takers. Overall, the results satisfactory and the information gathered will be helpful for furthering the understanding of why accidents occur.

In the future research, it may be helpful to conduct, personal interviews to gather additional information. In some cases, the respondents may have chosen to put text book answers even though the survey is anonymous. They may have answered according to what they feel is right as opposed to what they actually do, or witness. Also, for further research, it would be beneficial to compare the results from the McCarran Airport project to other Bechtel projects. It would also be valuable to examine responses between jobsites that act as construction managers, such as the McCarran project, versus jobsites who have direct hires. I am certain that the companies' ethics and attitude toward safety play a role in the behavior of their employees. Moreover, it would be interesting to see how behaviors varied among other companies when compared to Bechtel. Bechtel emphasizes for safety and employees are fully aware that safety ranks number one within the company. Some companies may provide employees with safety information but not truly have a culture of safety. I have worked with other companies that advocate safety but do not enforce safety regulations. Bechtel does not let schedule interrupt safety and there may be companies that do not have this policy. I believe this management down strategy affected the results of the survey. Overall, it would be beneficial to conduct the same

survey on a grander scale in the future at different companies and geographic locations and the results can be compared so that attitudes and opinions can be contrasted according to company and location.

Summary

Overall the survey was useful in providing answers regarding current safety related issues at the Bechtel McCarran International Airport project. Respondents indicated varying reasons why they believe accidents occur. Respondents also provided useful information regarding the motivating factors that contribute to their safety compliance. This information can be used to create new safety programs and to improve existing safety programs. The survey results also provided an overview of the safety culture on the McCarran International Airport Project located in Las Vegas, Nevada. The results indicated, overwhelmingly, that employees feel that safety regulations are important. However, there is some breakdown in the actual execution of the safety regulations. Some, respondents indicated that it is okay in some situations to not follow safety regulations. This information is vital for management. It provides an opportunity to target specific areas where safety attitudes are lacking and make improvements. The survey was designed to examine specific behavioral factors of construction workers with regard to construction safety. This was achieved and the results indicated that there is room for improvement from a sociological and behavior standpoint.

The results provided insightful information to the different scenarios as far as age groups and construction experience and how they think about safety. One very beneficial point is that new hires have a different perspective than veteran workers and it is important to help everyone be performing at the same level when it comes to safety on the construction site. It is important that all employees are not afraid of getting hurt on a jobsite and everyone is comfortable performing their job functions. When people are in fear getting hurt it only adds stress and can

be an additional cause for accidents. The project provided a new insight into perception of worksite safety a great deal has been learned. In the words of Bechtel employees, “Think safe and work hard.”

Appendix A: Safety Survey

Safety Research Survey

(Non-Bechtel Related Survey)

The purpose of this Research Survey is to try and determine what causes accidents and how to prevent them in the future. Participation is voluntary, and participants must be at least 18 years old. . This survey should not take more than 15 minutes. All survey results are anonymous. The Survey can be completed with pen or pencil. Participation or non participation will not affect your employment. Please place finished survey in box located by Patricia Corbett's office or on table in inspector's office in front of PDC. Thank you for your participation.

Please consider each question carefully and provide an honest answer, your time and consideration will help improve the accuracy of this survey. Thank you.

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1. **Please choose your age category**

   a. 18 -25

   b. 26-30

   c. 31-40

   d. 41-50

   e. 50 and older

2. **How many years experience do you have in the construction industry?**

   a. 1-3

   b. 3-5

   c. 5-7

   d. 7-10

   e. 10 or more

3. **What is your gender (please circle)**

   Male

   Female

4. **Do you feel that the safety training you have received is effective? (Circle one number)**

Not Effective				Very Effective
1	2	3	4	5

5. **Do you believe that you are well informed about all safety regulations that apply to your daily work activities? (please circle)**

   Yes *No*

6. **Do you <u>ALWAYS</u> follow all safety regulations? (please circle)**

   Yes *No*

7. **If you answered <u>NO</u> to question 6, please explain your reasons for ignoring safety regulations?** (please write your answer below)

_____
_____
_____
_____

8. **What motivates you to follow safety regulations?** (Please write a number between 1 and 5 next to each item below. Put a 1 next to the item that is MOST important to you and a 5 next to the item that is LEAST important. Please use each number only once)

__ a. Fear of reprimand

__ b. Supervisor praise

__ c. Fear of injury

__ d. Desire to follow rules

__ e. Promotion

9. **Have you even been involved in, or witnessed, a safety related accident at work?** (please circle one)

Yes *No*

10. **If you answered <u>YES</u> to question 9, please state whether you were involved in the accident or you were a witness.** (please circle one)

Involved

Witness

11. **If you answered <u>YES</u> to question 9, what do you believe was the cause of the accident?** (please circle one)

__ a. Failure to properly use safety equipment (attempted to use safety equipment, but used equipment inappropriately)

__ b. Failure to acknowledge safety regulation (disregard of all safety elements)

__ c. Lack of awareness (for example: tiredness, not paying attention)

__ d. Failure to properly use machinery

__ e. Other (please explain) _____

12. **Do you feel that it is important to <u>ALWAYS</u> follow safety regulations?** (Circle one)

Yes *No*

Appendix B: Purdue Internal Review Board Confirmation Letter

PURDUE
UNIVERSITY

HUMAN RESEARCH PROTECTION PROGRAM
INSTITUTIONAL REVIEW BOARDS

To:	BRYAN HUBBARD KNOY
From:	RICHARD MATTES, Chair Social Science IRB
Date:	01/13/2010
Committee Action:	**Exemption Granted**
IRB Action Date:	01/12/2010
IRB Protocol #:	0912008779
Study Title:	An In Depth Study of How Psychological Behaviors Affect Construction Safety

The Institutional Review Board (IRB) has reviewed the above-referenced protocol and has determined that it qualifies for exemption pursuant to Federal regulations 45 CFR 46.101(b) exempt category(2) .

If you wish to revise or amend the protocol, please submit a revision request to the IRB for consideration. Please contact our office if you have any questions.

We wish you good luck with your work. Please retain copy of this letter for your records.

Ernest C. Young Hall, 10th Floor · 155 S. Grant St. · West Lafayette, IN 47907-2114 · (765) 494-5942 · Fax: (765) 494-9911

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